

**WHAT IS CLAIMED IS:**

- 1 1. A method for facilitating inverse multiplexing over asynchronous transfer mode,  
2 comprising:  
3 receiving a stream of sequentially aligned ATM cells via an originating end point  
4 logical communication link;  
5 associating a sequence identifier with each one of said ATM cells for creating  
6 sequence identified ATM cells; and  
7 forwarding said sequence identified ATM cells in a distributed manner over a  
8 plurality of IM communication links, wherein a first one of said IM communication  
9 links having disparate data transmission rates in at least one data transmission  
10 direction with respect to a second one of said IM communication links.
- 1 2. The method of claim 1 wherein associating the sequence identifier includes  
2 determining a sequence code for each one of said ATM cells and inserting the  
3 sequence code for each one of said ATM cells into an information payload portion of a  
4 corresponding one of said ATM cells.
- 1 3. The method of claim 1 wherein associating the sequence identifier includes  
2 determining a sequence code for each one of said ATM cells and inserting the  
3 sequence code for each one of said ATM cells into a header portion of a corresponding  
4 one of said ATM cells.
- 1 4. The method of claim 1 wherein associating the sequence identifier is facilitated by an  
2 originating endpoint IMA-ADSL communication device.
- 1 5. The method of claim 1 wherein forwarding said sequence identified ATM cells in a  
2 distributed manner over a plurality IM communication links includes forwarding said  
3 sequence identified cells over a plurality of IM-ADSL communication links.
- 1 6. The method of claim 5 wherein:

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2 a first one of said IM-ADSL communication links is synchronized at a first  
3 upstream data transmission rate; and  
4 a second one of said IM-ADSL communication links is synchronized at a second  
5 upstream data transmission rate different than the first upstream data transmission rate.

1 7. The method of claim 5 wherein:

2 a first one of said IM-ADSL communication links is synchronized at a first  
3 downstream data transmission rate; and  
4 a second one of said IM-ADSL communication links is synchronized at a second  
5 downstream data transmission rate different than the first downstream data  
6 transmission rate.

1 8. The method of claim 5 wherein:

2 a first one of said IM-ADSL communication links is synchronized at a first  
3 downstream data transmission rate and at a first upstream data transmission rate; and  
4 a second one of said IM-ADSL communication links is synchronized at a second  
5 downstream data transmission rate different than the first downstream data  
6 transmission rate and at a second upstream data transmission rate different than the  
7 first upstream data transmission rate.

1 9. The method of claim 1, further comprising:

2 receiving said sequence identified ATM cells by a destination endpoint IMA  
3 communication device; and  
4 forwarding an aligned stream of inversely multiplexed ATM cells across a  
5 destination endpoint logical communication link.

1 10. The method of claim 9 wherein receiving said sequence identified ATM cells includes  
2 holding at least a portion of said sequence identified ATM cells in a data storage  
3 device.

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- 1 11. The method of claim 10 wherein forwarding the aligned stream of inversely  
2 multiplexed ATM cells includes sequentially retrieving said sequence identified ATM  
3 cells from the data storage device.
- 1 12. The method of claim 11 wherein sequentially retrieving said sequence identified ATM  
2 cells includes determining the sequence identifier associated with a plurality of said  
3 sequence identified ATM cells.
- 1 13. The method of claim 1, further comprising:  
2 receiving said sequence identified ATM cells at a destination endpoint IMA  
3 communication device;  
4 determining a next one of said sequence identified ATM cells to forward over a  
5 destination endpoint logical communication link; and  
6 forwarding the next one of said sequence identified ATM cells over the destination  
7 endpoint logical communication link.
- 1 14. The method of claim 13 wherein determining the next one of said sequence identified  
2 ATM cells includes determining the sequence identifier for a plurality of sequence  
3 identified ATM cells.
- 1 15. The method of claim 13 wherein determining and forwarding are facilitated by the  
2 destination endpoint IMA communication device.

1 16. A method for facilitating inverse multiplexing over asynchronous transfer mode,  
 2 comprising:  
 3 receiving a stream of sequentially aligned ATM cells via an originating end point  
 4 logical communication link;  
 5 determining a sequence code for each one of said ATM cells;  
 6 inserting the sequence code for each one of said ATM cells into an information  
 7 block a corresponding one of said ATM cells for creating sequence identified ATM  
 8 cells;  
 9 forwarding said sequence identified ATM cells in a distributed manner over a  
 10 plurality of IM communication links, wherein a first one of said IM communication  
 11 links having disparate data transmission rates in at least one data transmission  
 12 direction with respect to a second one of said IM communication links;  
 13 receiving said sequence identified ATM cells at a destination endpoint IMA  
 14 communication device;  
 15 determining a next one of said sequence identified ATM cells to forward over a  
 16 destination endpoint logical communication link; and  
 17 forwarding the next one of said sequence identified ATM cells over the destination  
 18 endpoint logical communication link.

1 17. The method of claim 16 wherein forwarding said sequence identified ATM cells in a  
 2 distributed manner over a plurality IM communication links includes forwarding said  
 3 sequence identified cells over a plurality of IM-ADSL communication links, each one  
 4 of the plurality of IM-ADSL communication links synchronized at disparate data  
 5 transfer rates relative to each other one of the plurality of IM-ADSL communication  
 6 links.

1 18. An apparatus for facilitating inverse multiplexing over asynchronous transfer mode  
 2 (IMA), the apparatus including an originating endpoint IMA communication device, a  
 3 destination endpoint IMA communication device, and a plurality of IM  
 4 communication links implemented therebetween, a first one of said IM communication  
 5 links synchronized at a disparate data transmission rate in at least one data  
 6 transmission direction with respect to a second one of said IM communication links,  
 7 the originating endpoint IMA communication device being capable of:

8 receiving a stream of sequentially aligned ATM cells via an  
 9 originating end point logical communication link;

10 associating a sequence identifier with each one of said ATM cells  
 11 for creating sequence identified ATM cells; and

12 forwarding said sequence identified ATM cells in a distributed  
 13 manner over the plurality of IM communication links, wherein a first one of  
 14 said IM communication links having disparate data transmission rates in at  
 15 least one data transmission direction with respect to a second one of said  
 16 IM communication links.

1 19. The apparatus of claim 18 wherein the originating endpoint IMA communication  
 2 device being capable of associating the sequence identifier includes the originating  
 3 endpoint IMA communication device being capable of determining a sequence code  
 4 for each one of said ATM cells and inserting the sequence code for each one of said  
 5 ATM cells into a information payload portion of a corresponding one of said ATM  
 6 cells.

1 20. The apparatus of claim 18 wherein the originating endpoint IMA communication  
 2 device being capable of associating the sequence identifier includes the originating  
 3 endpoint IMA communication device being capable of determining a sequence code  
 4 for each one of said ATM cells and inserting the sequence code for each one of said  
 5 ATM cells into a header portion of a corresponding one of said ATM cells.

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- 1     21. The apparatus of claim 18 wherein the originating endpoint IMA communication  
2         device is an originating endpoint IMA-ADSL communication device, the destination  
3         endpoint IMA communication device is a destination end-point IMA-ADSL  
4         communication device and the plurality of IM communication links are a plurality of  
5         IM-ADSL communication links.
- 1     22. The apparatus of claim 21 wherein:  
2         a first one of said IM-ADSL communication links is synchronized at a first  
3         upstream data transmission rate; and  
4         a second one of said IM-ADSL communication links is synchronized at a second  
5         upstream data transmission rate different than the first upstream data transmission rate.
- 1     23. The apparatus of claim 21 wherein:  
2         a first one of said IM-ADSL communication links is synchronized at a first  
3         downstream data transmission rate; and  
4         a second one of said IM-ADSL communication links is synchronized at a second  
5         downstream data transmission rate different than the first downstream data  
6         transmission rate.
- 1     24. The apparatus of claim 21 wherein:  
2         a first one of said IM-ADSL communication links is synchronized at a first  
3         downstream data transmission rate and at a first upstream data transmission rate; and  
4         a second one of said IM-ADSL communication links is synchronized at a second  
5         downstream data transmission rate different than the first downstream data  
6         transmission rate and at a second upstream data transmission rate different than the  
7         first upstream data transmission rate.
- 1     25. The apparatus of claim 18 wherein the destination endpoint IMA communication  
2         device being capable of:  
3                 receiving said sequence identified ATM cells; and

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4 forwarding an aligned stream of inversely multiplexed ATM cells  
5 across a destination endpoint logical communication link.

1 26. The apparatus of claim 25 wherein the destination endpoint IMA communication  
2 device being capable of receiving said sequence identified ATM cells includes the  
3 destination endpoint IMA communication device being capable of holding at least a  
4 portion of said sequence identified ATM cells in a data storage device.

1 27. The apparatus of claim 26 wherein the destination endpoint IMA communication  
2 device being capable of forwarding the aligned stream of inversely multiplexed ATM  
3 cells includes the destination endpoint IMA communication device being capable of  
4 sequentially retrieving said sequence identified ATM cells from the data storage  
5 device.

1 28. The apparatus of claim 27 wherein the destination endpoint IMA communication  
2 device being capable of sequentially retrieving said sequence identified ATM cells  
3 includes the destination endpoint IMA communication device being capable of  
4 determining the sequence identifier associated with a plurality of said sequence  
5 identified ATM cells.

1 29. The apparatus of claim 18 wherein the destination endpoint IMA communication  
2 device is capable of:  
3 receiving said sequence identified ATM cells via at least two of the plurality of IM  
4 communication links;  
5 determining a next one of said sequence identified ATM cells to forward over a  
6 destination endpoint logical communication link; and  
7 forwarding the next one of said sequence identified ATM cells over the destination  
8 endpoint logical communication link.

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- 1 30. The apparatus of claim 29 wherein the destination endpoint IMA communication
- 2 device being capable of determining the next one of said sequence identified ATM
- 3 cells includes the destination endpoint IMA communication device being capable of
- 4 determining the sequence identifier for a plurality of sequence identified ATM cells.

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31. An apparatus for facilitating inverse multiplexing over asynchronous transfer mode, the apparatus including an originating endpoint IMA-ADSL communication device, a destination endpoint IMA-ADSL communication device, and a plurality of IM communication links implemented therebetween, a first one of said IM-ADSL communication links synchronized at a disparate data transmission rate in at least one data transmission direction with respect to a second one of said IM communication links, the originating endpoint IMA-ADSL communication device being capable of:

- receiving a stream of sequentially aligned ATM cells via an originating end point logical communication link;
- determining a sequence code for each one of said ATM cells;
- inserting the sequence code for each one of said ATM cells into an information block a corresponding one of said ATM cells for creating sequence identified ATM cells;
- forwarding said sequence identified ATM cells in a distributed manner over a plurality of IM communication links, wherein a first one of said IM communication links having disparate data transmission rates in at least one data transmission direction with respect to a second one of said IM communication links; and

the originating endpoint IMA-ADSL communication device being capable of:

- receiving said sequence identified ATM cells at a destination endpoint IMA communication device;
- determining a next one of said sequence identified ATM cells to forward over a destination endpoint logical communication link; and
- forwarding the next one of said sequence identified ATM cells over the destination endpoint logical communication link.

1 32. A data processor program product, comprising:

2 a data processor program processable by a data processor of an originating  
3 endpoint IMA communication device; and

4 an apparatus from which the data processor program is accessible by the data  
5 processor of the originating endpoint IMA communication device;

6 the data processor program being capable of enabling the originating endpoint  
7 IMA communication device to:

8 receive a stream of sequentially aligned ATM cells via an  
9 originating end point logical communication link;

10 associate a sequence identifier with each one of said ATM cells for  
11 creating sequence identified ATM cells; and

12 forward said sequence identified ATM cells in a distributed manner  
13 over a plurality of IM communication links to a destination endpoint IMA  
14 communication device, wherein a first one of said IM communication links  
15 having disparate data transmission rates in at least one data transmission  
16 direction with respect to a second one of said IM communication links.

1 33. The data processor program of claim 32 wherein the data processor program being

2 capable of enabling the originating endpoint IMA communication device to associate  
3 the sequence identifier includes the data processor program being capable of enabling  
4 the originating endpoint IMA communication device to determine a sequence code for  
5 each one of said ATM cells and to insert the sequence code for each one of said ATM  
6 cells into an information payload portion of a corresponding one of said ATM cells.

1 34. The data processor program of claim 32 wherein the data processor program being

2 capable of enabling the originating endpoint IMA communication device to associate  
3 the sequence identifier includes the data processor program being capable of enabling  
4 the originating endpoint IMA communication device to determine a sequence code for  
5 each one of said ATM cells and to insert the sequence code for each one of said ATM  
6 cells into a header portion of a corresponding one of said ATM cells.

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1 35. The data processor program of claim 32 wherein the data processor program being  
2 capable of enabling the originating endpoint IMA communication device to forward  
3 said sequence identified ATM cells in a distributed manner over a plurality IM  
4 communication links includes the data processor program being capable of enabling  
5 the originating endpoint IMA communication device to forward said sequence  
6 identified cells over a plurality of IM-ADSL communication links.

1 36. The data processor program of claim 35 wherein:  
2 a first one of said IM-ADSL communication links is synchronized at a first  
3 upstream data transmission rate; and  
4 a second one of said IM-ADSL communication links is synchronized at a second  
5 upstream data transmission rate different than the first upstream data transmission rate.

1 37. The data processor program of claim 35 wherein:  
2 a first one of said IM-ADSL communication links is synchronized at a first  
3 downstream data transmission rate; and  
4 a second one of said IM-ADSL communication links is synchronized at a second  
5 downstream data transmission rate different than the first downstream data  
6 transmission rate.

1 38. The data processor program of claim 35 wherein:  
2 a first one of said IM-ADSL communication links is synchronized at a first  
3 downstream data transmission rate and at a first upstream data transmission rate; and  
4 a second one of said IM-ADSL communication links is synchronized at a second  
5 downstream data transmission rate different than the first downstream data  
6 transmission rate and at a second upstream data transmission rate different than the  
7 first upstream data transmission rate.

1 39. A data processor program product, comprising:

2 a data processor program processable by a data processor of a destination endpoint  
3 IMA communication device; and

4 an apparatus from which the data processor program is accessible by the data  
5 processor of the destination endpoint IMA communication device;

6 the data processor program being capable of enabling the destination endpoint  
7 IMA communication device to:

8 receive sequence identified ATM cells in a distributed manner via a  
9 plurality of IM communication links from an originating endpoint IMA  
10 communication device ; and

11 forward an aligned stream of inversely multiplexed ATM cells  
12 across a destination endpoint logical communication link.

1 40. The data processor program of claim 39 wherein the data processor program being  
2 capable of enabling the destination endpoint IMA communication device to receive  
3 said sequence identified ATM cells includes the data processor program being capable  
4 of enabling the destination endpoint IMA communication device to hold at least a  
5 portion of said sequence identified ATM cells in a data storage device.

1 41. The data processor program of claim 40 wherein the data processor program being  
2 capable of enabling the destination endpoint IMA communication device to forward  
3 the aligned stream of inversely multiplexed ATM cells includes the data processor  
4 program being capable of enabling the destination endpoint IMA communication  
5 device to sequentially retrieve said sequence identified ATM cells from the data  
6 storage device.

1 42. The data processor program of claim 41 wherein the data processor program being  
2 capable of enabling the destination endpoint IMA communication device to  
3 sequentially retrieve said sequence identified ATM cells includes the data processor  
4 program being capable of enabling the destination endpoint IMA communication

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5 device to determine the sequence identifier associated with a plurality of said sequence  
6 identified ATM cells.

1 43. The data processor program of claim 39 wherein the data processor program being  
2 capable of enabling the destination endpoint IMA communication device to forward an  
3 aligned stream of inversely multiplexed ATM cells includes the data processor  
4 program being capable of enabling the destination endpoint IMA communication  
5 device to:

6 determine a next one of said sequence identified ATM cells to  
7 forward over the destination endpoint logical communication link; and  
8 forward the next one of said sequence identified ATM cells over the  
9 destination endpoint logical communication link.

1 44. The data processor program of claim 13 wherein the data processor program being  
2 capable of enabling the destination endpoint IMA communication device to determine  
3 the next one of said sequence identified ATM cells includes the data processor  
4 program being capable of enabling the destination endpoint IMA communication  
5 device to determine the sequence identifier for a plurality of sequence identified ATM  
6 cells.